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ABSTRACT

A study examined the nature of the schematic processes for a story presented in television, text, and radio form and for a story presented to above average and average readers. The story was parsed according to J. M. Mandler and N. S. Johnson's story grammar. Schematic processing was inferred from the pattern of node memorability for the different media and reading conditions. In addition, the absolute levels of performance on recall, recognition, and reordering memory tasks were compared for different media and reading conditions. Subjects, 88 sixth grade students of above average or average reading ability, were presented a story in either television, text, or radio form. The story schema was similar for stories presented on radio and text and these two forms of media differed from television. In addition, the story schema for above average and average readers was similar. In terms of absolute levels of memory performance, memory was better in the television condition than in either the text or radio conditions, while performance in the text and radio conditions did not differ. The memory for setting, beginning, goal, and reaction information varied as a function of the medium. (Author/FL)

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A Comparison of Schematic Processes in Memory

for a Television, Text, and Radio Story

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Running head: STORY MEMORY

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Abstract

This study examines the nature of the schematic processes for a story presented in television, text, and radio form and for a story presented to above average and average readers. The story was parsed according to Mandler and Johnson's (1977) story grammar. Schematic processing was inferred from the pattern of node memorability for the different media and reading conditions. In addition, the absolute levels of performance on recall, recognition and reordering memory tasks were compared for different media and reading conditions. Eighty-eight sixth graders of above average or average reading ability were presented a story in either television, text, or radio form. The story schema was similar for stories presented on radio and text and these two forms of media differed from television. In addition, the story schema for above average and average readers was similar. In terms of absolute levels of memory performance, memory was better in the television condition than in either the text or radio conditions, while performance in the text and radio conditions did not differ. The memory for setting, beginning, goal, and reaction information varied as a function of the medium. The relevance of the results to recent advances in our understanding of media and reading effects on story memory is articulated.

A Comparison of Schematic Processes in Memory
for a Television, Text, and Radio Story

The principle aim of this study was to compare the schematic processes in memory for a story presented in television, text, and radio form. Much research supports the contention that children and adults use a story schema in the process of remembering and understanding orally presented stories (Mandler & Johnson, 1977; Rumelhart, 1975; Stein & Glenn, 1979; Thorndyke, 1977). Recent research has documented the psychological validity of the story schema approach for stories presented in text form (Mandler & Goodman, in press). Little is known, however, about how a story schema affects memory and comprehension processes for a televised story, or how the story schema used for television differs from the story schema used for text or radio stories.

A schema is a hypothetical data structure which contains different kinds of knowledge and expectations used in the processing of new information. Recently, investigators interested in articulating the cognitive processes involved in television viewing have noted the relevance of schema research (Anderson & Lorch, 1983; Salomon, 1981). Collins (1981) has discussed three types of prior knowledge, or schema, that appear critical for television comprehension: familiarity with exposition formats, knowledge and experience of the social world, and understanding of presentation conventions and formal features. The present study is concerned with only the first type of schema, knowledge of exposition formats, hereupon

termed story schema. This refers to the viewer's knowledge that television programs vary in their internal structure. Following exposure to a particular program, or program genre, the viewer develops expectations about the type and order of story information presented. These expectations, or schema, act as a cognitive template against which the information presented in novel program episodes is compared and consequently comprehended and interpreted. As a first step towards understanding schematic processing in television, the present research utilizes a cross media approach and applies a methodology previously shown to be useful in delineating the nature of the story schema in other forms of media to a story presented in televised form.

In the present study, Mandler and Johnson's (1977) story grammar was used to investigate schematic processes in the media conditions. A story grammar was employed for two reasons. First, a story grammar provides a principled method for parsing a story into structural units or nodes. Consequently, the utilization of the story grammar approach allows a comparison of the media in terms of absolute levels of memory for specific story constituents. Second, a large number of studies have confirmed the usefulness of the approach for stories presented in either radio or text form. The majority of research has consisted of presenting a noncanonical story to subjects and measuring the canonical characteristics of the story recall. (A noncanonical story differs from the grammar's rules of "good form.") The consistent finding that the recalled story approximates canonical

rather than noncanonical form is assumed to occur because of the operation of the story schema during retrieval (Glenn, 1978; Mandler, 1978; Mandler & DeForest, 1979; Mandler & Johnson, 1977; Stein & Nezworski, 1978).

Of greater interest, for the purpose of the present study, is the finding that the overall pattern of node recall is consistently the same. Settings, beginnings, and outcomes tend to be well recalled while attempts, endings, reactions, and goals are poorly recalled. This pattern of node memorability has been found for good and poor readers (Weaver & Dickinson, 1982), learning disabled adults (Worden, Malmgren, & Gabourie, in press), schooled and nonschooled Liberian subjects (Mandler, Scribner, Cole, & DeForest, 1980), and four-year-old children (Day, Stein, & Trabasso, 1979). The story schema is assumed to affect the degree to which individual story nodes are recalled, resulting in the generally observed pattern described previously (Mandler & DeForest, 1979). In the present study, the nature of the story schema is inferred from the pattern of node recall which results in the three media conditions.

A brief description of the basic nodes of the story grammar and its rewrite rules follows. (For a more detailed description of this approach to story memory and comprehension, see Stein, 1982.) The story grammar consists of a series of rewrite rules that specify: (a) the type of story information (or nodes) contained in an ideal story, (b) the order in which the story nodes appear, and (c) the relationships between nodes. Six, and occasionally seven, basic

story nodes have been defined in previous research. The setting node introduces the protagonist of the first episode and frequently includes information about the social, physical, or temporal context of the story. The beginning node consists of the expression of events which causes the protagonist to react. The simple reaction represents the protagonist's emotional response or thoughts caused by the beginning event. The protagonist plans what to do about the beginning event in the goal statements. The attempt represents planful and nonplanful acts carried out by the protagonist. The outcome contains information about the success or failure of the attempt. The ending node can represent either the long range consequence of the attempt or can be simply an emphatic statement about the consequences.

Absolute Levels of Memory Performance

In addition to examining schematic processes, the present study avails a comparison of the absolute levels of performance in the television, text, and radio conditions on a variety of memory measures. This comparison addresses the question, "From which medium do children remember more?" Previous research has dealt with portions of the question. Barrow and Westley (1959), using a recall test, and Wetstone and Friedlander (1974) using a multiple-choice comprehension test, reported that children perform better in an auditory-visual than auditory only condition. Beagles-Roos and Gat (1983) compared television and radio presentation conditions and reported that in the television condition, children recalled more story details and

were more likely to draw inferences based on story actions. Meringoff (1980) compared children's memory for stories presented on television with their memory for stories read to them. The results were generally similar to those reported by Beagles-Roos and Gat (1983). Children in the television condition recalled more story actions and were more likely to base inferences on visually presented information. Children in the listening condition recalled more story vocabulary and were more likely to base inferences on information presented auditorily in the story and their world knowledge.

Baggett (1979) reported that subjects exposed to a movie story (with no dialogue) recalled more than subjects exposed to a text story, both immediately after the story presentation and one week later. Baggett (1979) also measured recall of structural statements (the story's exposition, complication, and resolution) and found no media differences immediately after the story presentation. One week later, however, subjects in the movie condition recalled more story structure than those in the text condition. Further, Baggett and Ehrenfeucht (in press) measured children's and adult's ability to correctly order pictures and sentences taken from a story presented in either text or movie form. Children were more accurate in the reordering task when exposed to the filmed story, while adults were equally accurate in both media conditions.

Pezdek and Lehrer (1983) was the only study that compared all three media on similar measures within a single study. Eight-year-old children (beginning readers) and 11-year-old children (more

advanced readers) read one story and were presented either the radio or television version of another story. After each media presentation, a battery of memory and comprehension tests was administered. This design allowed within-subject comparisons of performance on each task, as well as an analysis of absolute levels of performance in each media condition. The within-subject correlations suggested that the cognitive processes involved in reading comprehension were similar to those involved in comprehending radio but not television. Further, the absolute level of memory performance was generally similar in the television and reading conditions, and performance was better in both of these conditions than in the radio condition.

In addition to medium of presentation, two other variables, delay of test and reading ability, were manipulated in the present study and the effects on story memory measured. The delay of test variable was manipulated to test Baggett's (1979) finding that memory for story structure deteriorated faster for a text story than for a movie story. The rationale for studying the effects of reading ability stems from two studies. First, Weaver and Dickinson (1982) reported that there were few differences between normal and disabled readers in their recall of story grammar units. Poor readers recalled fewer statements in the reaction and minor setting categories than good readers, but the recall of the other five story nodes was not significantly different. In addition, in terms of the rank order of story category information recalled, the pattern

for normal fifth graders and disabled readers was highly comparable, with only one inversion of order of adjacent categories. Weaver and Dickinson (1982) conclude that normal and disabled readers have similar story schema. Their conclusion contradicts current speculation that good and poor readers differ in the top down processing of textual information, of which schema utilization is an example (Carr, 1981; Guthrie, 1976). The second relevant study is Pezdek and Lehrer (1983) which found that radio comprehension was significantly correlated with a subject's standardized reading score while television comprehension was not correlated with reading ability. On the basis of previous research, then, it was of interest to compare the story schema for above average and average readers and to compare the two reading groups in terms of absolute levels of performance in the three media conditions.

To summarize, schematic processes for a story presented in different media and to above average and average readers will be compared. The story schema will be inferred from the pattern of node memorability which results in each media and reading condition. In addition, absolute levels of performance on a battery of memory tasks will be measured.

Method

Subjects and Design

Eighty-eight sixth grade children (mean age, 12.08 years) were tested. The children were selected from three ethnically diverse public schools in the Los Angeles metropolitan area. The sex and

ethnic mixture of the subjects were approximately equal in each media condition, but these factors were not specifically controlled. For some of the subjects tested, English was the second language. Of those children, however, only the students who did not receive school administered tutoring in English and who scored above the 60th percentile on a standardized state-administered reading test were used. Above average readers were defined as those subjects scoring in the 80th percentile or above (mean percentile score = 92.7, SD = 5.3) and average readers as those scoring in the 60th to 79th percentile (mean percentile score = 69.2, SD = 7.9).

The primary independent variables in the study were media condition, reading ability, and delay of test. The first two variables were between subject factors; delay of test was a within subject factor.

Materials

The story used was entitled A Story, A Story, an African folk tale by Gail Haley. This story was also used by Beagles-Roos and Gat (1983), Meringoff (1980) and Pezdek and Lehrer (1983). The story was novel to all children. The media versions of the story were prepared by Weston Woods, an educational publishing house located in Weston, Connecticut. The original materials by Weston Woods were edited such that there were three matched versions of each story: (a) a story book without pictures, (b) a radio version, and (c) a television version in color. The audiotracks in the television and radio conditions were identical, and these were the

same as the transcript of the text. The same verbal material was thus included in each condition. The television and radio versions of the story were 8 minutes, 29 seconds in length. Subjects in the text condition required, on the average, 10 minutes, 30 seconds to read the story.

Procedure

The children were individually tested at their schools by the experimenter. They were presented the story in either the television, text, or radio conditions. The television segments were presented on a 19 inch color television. The "radio" segments were presented on a portable cassette tape recorder. Subjects in the text condition read the story out loud to ensure that their word decoding was accurate, and received occasional assistance in pronunciation. Immediately following the story presentation, a three minute intervening task was given, in which the subjects were asked to complete a short mathematics quiz. The purpose of the intervening task was to insure that the subsequent tests measured long-term memory.

A battery of five tests was administered. These included: (a) story recall, (b) sentence recognition, (c) picture recognition, (d) sentence reordering, and (e) picture reordering. The recall, recognition and reordering tests were always administered in this order. The order of presenting the picture and sentence tests was counterbalanced across subjects.

In the recall test, subjects were given the first sentence

from the story as a prompt and instructed to recall the rest of the story verbatim. The recall protocols were tape-recorded and later transcribed for coding. In the sentence recognition test, subjects were presented ten sentences, one at a time on cards. Their task was to read each sentence aloud and indicate whether the sentence had been in the preceding story. Half of the sentences were from the story and half were distractor sentences. The five sentences from the story were selected from different episodes. The distractor sentences were constructed to be similar to the sentences in the story, but semantically inconsistent with the plot.

In the picture recognition test subjects were presented eight pictures, one at a time. Half of the pictures had been presented in the television version of the story and half were distractor pictures. The pictures from the story were selected from four different episodes. The distractor pictures were selected from another story book of African folktales. In the radio and text conditions the picture recognition and reordering tests served as inferential tests rather than memory tests since these subjects had not previously seen the pictures.

The recognition data were scored in terms of the signal detection measure of d' . The values of d' reflect subjects' recognition sensitivity in distinguishing the original items from the distractor items. (See Banks, 1978, for an explanation of Signal Detection Theory.) The procedure outlined by Hochhaus (1972) was followed for calculating d' values.

Following the recognition tests, the sentence and picture reordering tasks were administered. In the sentence reordering test, subjects were presented ten sentences from the story, two from each of five story episodes. In the picture reordering task subjects were presented five pictures, one from each of five story episodes. Their task was to place the items in the order they were presented in the story, from beginning to end. The ten sentences and the five pictures were presented to all subjects in the same random order. The reordering task was scored on the basis of the number of displacement errors, that is, how far each item was placed from its correct position in the series. Consider the example where the pictures were ordered 1,3,4,2,5. Items 1 and 5 are in their correct positions. Items 3 and 4 are each displaced by one space from their correct positions and item 2 is displaced by two spaces. The total displacement error in this example is four.

The recognition and reordering tests were administered a second time one week later.

Coding recall data. In the initial phase of coding the recall data, three experimenters familiar with the Mandler and Johnson (1977) story grammar parsed the majority of the story. Two of the 7 episodes were excluded from this analysis and subsequent data analyses due to the story length.

In the second phase of coding the recall data, the transcribed

recall protocols were divided into propositions. Each proposition included a predicate (e.g., a verb or adjective) and its arguments. An experimenter blind to the conditions of the experiment scored the protocols for the presence of the propositions, and also for additions and distortions. A strict criterion, as explicated in Mandler (1978, p. 23) was used to determine if the meaning of each proposition was adequately expressed. The definition of a strict criterion is that only those recalled propositions which express the "essential meaning" of the story proposition should be included. Fragments of propositions, in which only a small part of the main event is included, were not scored as recalled.

Additions and distortions were combined into one category. Recalled material which had not been included in the original story was coded in this manner. The category of additions and distortions did not include redundancies of information recalled earlier or mistakes about which character carried out a particular action.

To determine coding reliability, a second experimenter was instructed in the coding criteria and coded 60% of the recall protocols. The agreement of the scored presence of propositions and additions and distortions was calculated using Cohen's Kappa. This statistic is interpreted as the proportion of joint judgments in which there is agreement, after chance agreement is excluded (Cohen, 1960). The coefficient of interjudge agreement calculated in this manner was .95. Disagreements in the coding decisions were resolved through discussion.

The story propositions were grouped according to the appropriate story node. The number of propositions recalled from each node was calculated for every subject and expressed as a proportion of the total number of propositions presented in each node. The nodes included in the analysis were setting, beginning, reaction, goal, attempt, outcome and ending.

Results

The results are organized in the following manner. First, the story schema in the three media conditions and for above average and average readers will be described. Second, absolute levels of performance in the three media conditions and for above average and average readers will be presented. All effects were assessed at the .05 level of significance, using two-tailed tests.

Story Schema

The recall data were used in the analyses to compare the story schema in the media and reading conditions. The nature of the story schema was inferred from the pattern of node memorability. Univariate F tests were used in these analyses to obtain the appropriate mean square error term and subsequently calculate Tukey's HSD tests for each media and reading condition separately. The media by reading group interaction was not of interest in the analysis of story schema, hence the use of univariate tests.

Three one-way ANOVAs were performed separately on recall of story nodes in the television, text, and radio conditions. Memory varied significantly by story node in the television ($F(6, 144) = 18.01$, $MS_e = 458.29$), text ($F(6, 150) = 6.61$, $MS_e = 663.99$),

and radio conditions ($F(6, 114) = 3.61, MS_e = 639.98$). In Table 1 are listed the mean proportion of story nodes recalled in each media. Tukey's HSD test was used to analyze differences in all pairwise comparisons of memory for story nodes within each media condition. The basic findings are summarized as follows. Node memorability varied more in the television condition than in either the text or radio conditions. In the televised story, endings and beginnings were better recalled than settings, goals and reactions. Outcomes and attempts were better recalled than goals and reactions, and goals and settings were better recalled than reactions. In the text and radio conditions, attempts, outcomes, and endings were better recalled than settings. In addition, in the text condition, goals and beginnings were better recalled than settings. Television differed from the other two media in the number of significant differences in all pairwise comparisons of nodes as well as in the overall pattern of node memorability. In television, 12 of the pairwise comparisons reached significance while there were five significant comparisons in the text condition and three in the radio condition. There is a greater similarity in the pattern of node memorability in the text and radio conditions as compared to the television condition.

Two one-way ANOVAs were performed on recall of story nodes for above average and average readers separately. The memory for story nodes varied significantly for above average readers ($F(6, 210) = 12.18, MS_e = 624.52$) and average readers ($F(6, 228) = 4.95, MS_e = 577.54$).

In Table 1 are listed the mean proportion of story nodes recalled in each reading condition. Tukey's test was used to analyze differences. Node memorability varied slightly more among above average readers, but the general pattern was similar for both groups. For above average and average readers, endings and beginnings were better recalled than settings and reactions. In addition, among above average readers, outcomes and attempts were better recalled than settings and reactions.

Insert Table 1 about here

In summary, an analysis of the pattern of node memorability revealed that the story schema for television is different from the story schema for text and radio, and the story schema is similar for above average and average readers.

Absolute Levels of Performance

In the preceding analysis, the pattern of story node memorability was examined separately in each media and reading condition. In the present analysis, performance on a battery of memory measures was compared across media and reading conditions. The question of interest was, "In what media and reading condition do subjects remember more?" Separate multivariate analyses of variance were carried out on the recall, recognition, and reordering data. The results are reported in the following order: recall, recognition, and reordering memory for the three media conditions, then recall, recognition and reordering memory for above average and average readers.

Media results. The recall data were analyzed using a 3(media) x 2(reading group) multivariate analysis of variance design. There were eight dependent variables: (a) the proportion recalled of each of seven story nodes, and (b) the total number of story propositions recalled. There was a significant effect of medium ($F(2, 69) = 3.07$). Univariate F tests with (2, 69) degrees of freedom indicated that the total number of story propositions ($F = 3.40$, $MS_e = 94.95$), settings ($F = 3.90$, $MS_e = .09$), goals ($F = 3.20$, $MS_e = .08$), beginnings ($F = 8.27$, $MS_e = .03$) and reactions ($F = 3.08$, $MS_e = .13$), were recalled differently as a function of the medium of presentation (see Table 1). The multivariate contrast of TV versus text and radio was significant for the total number of story propositions recalled ($t = 2.51$) as well as for the following story nodes: setting ($t = 2.40$), beginning ($t = 3.78$) and reactions ($t = -2.46$). The multivariate contrast of text versus radio was significant for goals ($t = 2.44$) and settings ($t = -2.41$) and insignificant for beginnings and reactions.

The next series of analyses examined the absolute levels of performance on recognition and reordering tests. The recognition and reordering data were analyzed using a 3(media) x 2(reading group) x 2(delay of test) x 2(picture or sentence memory task) multivariate analysis.

In Table 2 are listed the mean memory scores for the picture and sentence recognition data and the picture and sentence reordering data. The main effect of medium was significant for both the

recognition ($F(2, 79) = 22.97$) and reordering data ($F(2, 76) = 10.41$). Individual t tests were performed on the four memory measures in the television, text, and radio conditions. On each memory measure, performance in the television condition was better than in either the text or radio conditions while performance in the text and radio conditions did not significantly differ. Together, the recall, recognition, and reordering data provide strong support for the conclusion that levels of memory performance were similar in the text and radio conditions and were different from those obtained in the television condition.

Insert Table 2 about here

Reading results. In addition to examining media effects, the preceding multivariate analyses of variance also compared the performance of above average and average readers on recall, recognition and reordering memory tests. There was a significant main effect of reading ability on the recall of specific story nodes and the total number of story propositions recalled ($F(1, 69) = 6.41$). Univariate F tests with (1, 69) degrees of freedom indicated that the total number of story propositions recalled ($F = 42.55$, $MS_e = 94.95$), goals ($F = 8.67$, $MS_e = .08$), beginnings ($F = 25.57$, $MS_e = .03$), attempts ($F = 37.87$, $MS_e = .04$), outcomes ($F = 25.39$, $MS_e = .05$), and endings ($F = 32.58$, $MS_e = .04$) were better recalled by above average than average readers. Memory for settings and reactions did not differ for the two types of readers, although

the trend was in the same direction.

Good readers performed better than average readers in the recognition ($F(1, 79) = 37.07$) and reordering tests ($F(1, 76) = 19.20$). These data are presented in Table 2. In addition, there was an interesting significant interaction between reading ability and sentence versus picture task in the reordering ($F(1, 76) = 24.96$), but not the recognition data. Above average readers made fewer reordering errors on the sentence task than average readers. On the picture reordering task, however, the reading groups did not differ.

Some additional results emerged from the preceding multivariate analyses which examined media and reading effects on recall, recognition and reordering data. First, there was a significant media by reading level interaction with both the recall ($F(2, 69) = 1.85$) and the recognition data ($F(2, 79) = 6.21$). Simple effects tests carried out separately on above average and average readers indicated that above average readers did not significantly differ in recall of the total number of story propositions and recall of specific story nodes within the three media conditions. On the other hand, average readers recalled most in the television condition and least in the radio condition ($F(2, 69) = 4.01$). Simple effects tests were also carried out on the recognition data. For above average readers sentence recognition ($F(2, 79) = 4.05$) and picture recognition ($F(2, 79) = 33.07$) varied as a function of the medium. For both above average and average readers, when significant differences

were obtained, performance was best in the television condition and poorest in the radio condition.

The effects of test delay were of interest for the purpose of testing the replicability of Baggett's (1979) findings. The preceding multivariate analyses of variance of the recognition and reordering data provided the following results. Recognition memory was better on the immediate than the delayed test ($F(1, 79) = 5.97$). There was not a significant effect of test delay on reordering data. Unlike Baggett (1979), there was not a significant interaction of delay of test by media, for either the recognition or reordering data.

Finally, a separate ANOVA was performed on the number of additions and distortions recalled. The between subject factors were reading ability and media. Average readers recalled fewer additions and distortions ($\bar{X} = 2.27$) than above average readers ($\bar{X} = 4.84$, $F(1, 64) = 21.22$). However, the effect of medium was not significant, nor was there a significant reading by media interaction.

Discussion

This study addressed two issues. First, how did the story schema compare in the different media and reading conditions? Second, how did the absolute levels of memory performance vary as a function of the medium of presentation and reading ability? The discussion is organized around these issues.

Story Schema

The nature of the story schema was inferred from the observed

pattern of node memorability. This practice is consistent with much previous research which attributes the degree to which individual story nodes are remembered to the operation of a story schema during retrieval processes (Mandler & DeForest, 1979; Mandler, Scribner, Cole, & DeForest, 1980; Weaver & Dickinson, 1982). The results suggest that the story schema is similar for stories presented on radio and text and that these two forms of media differ from television. This conclusion is warranted given the findings that memory for story nodes varied more and differently in the television condition compared to the other media. While the pattern of node memorability was not identical in the text and radio conditions, the similarities were clear. In the text condition, settings were less well recalled than attempts, outcomes, endings, goals, and beginnings, compared to the radio condition, where settings were less well recalled than attempts, outcomes, and endings.

The story schema results reported here confirm and extend the findings of Pezdek and Lehrer (1983), who suggested that the underlying cognitive processes of television are different from those of text and radio. Pezdek and Lehrer (1983) used a within subject, correlational design to determine how performance on a battery of memory and comprehension measures varied as a function of the medium. Although there are differences in both the research design and measures employed by Pezdek and Lehrer and the present study, the same conclusions are warranted, i.e., cognitive processing is similar in text and radio and different from television.

Previous researchers, using an audio-only story presentation mode, found that settings, beginnings, and outcomes tend to be well recalled while attempts, endings, reactions and goals are poorly recalled (Mandler & Johnson, 1977). Those results are discrepant from the findings reported here. Generally, in the radio condition of the present research, fewer significant differences in the memory for story nodes were obtained. Also, settings were poorly recalled. The discrepancy between previous research and the results reported here, however, does not undermine the purpose of the present research; that is, to compare the story schema in different media and reading conditions. The primary comparison of interest here is the pattern of node memorability in the television, text, and radio conditions, and not the comparison of present to past research. Whatever the factors causing the discrepancy, it is assumed to be affecting the three media conditions similarly.

What accounts for the difference in schematic processes in television, on the one hand, and text and radio on the other? With the addition of the visual track in television, the story content being transmitted is different from the other, verbal only media. How does the addition of pictorial information affect schematic processes? Minsky's (1975) frame theory provides some useful vocabulary and concepts with which to address the question of schematic processing in television.

A frame is a data structure composed of higher and lower level nodes and relations. When some aspect of the input matches the

content of a frame, the frame is activated. A matching process ensues and results in each of the lower level "slots" being assigned values. In the present conceptualization, a frame can be likened to one story node, e.g., setting. Each frame is linked together to form a frame system. The frame system is comparable to a story schema.

Perhaps the activation of a story node frame is affected differently by pictorial input than by verbal input. Baggett (1979) has suggested that pictorial information is less specific in nature than linguistic information. Further, she suggested that the specificity of linguistic cues results in the activation of a single frame, while pictorial information may result in the activation of a number of frames. The subject is forced to attempt to match the pictorial input to a variety of frames in an effort to disambiguate the input. Consequently, when pictorial stimuli provide the input, more frames are activated and kept in activation while matches are attempted between the input and the preexisting values of the frame. The differences in the frame matching process for pictorial versus verbal information may have contributed to the finding in the present study that node memorability was better and different in the television condition than in the other, nonpictorial media.

Absolute Levels of Memory

Another issue of interest was how the absolute levels of performance on a variety of memory measures varied as a function of media and reading ability. The results from the recall data are discussed first, followed by the results from the recognition

and reordering data.

Recall of settings and beginnings was better in the television condition than in either the text or radio conditions, while the recall of reactions was worse in the television than text or radio conditions. Recall of goals was better in the text condition than in either the television or radio conditions. Meringoff (1980) and Meringoff, Vibbert, Char, Fernie, Banker, and Gardner (1983) have suggested that memory for story information may be differentially affected by the medium of presentation, depending on the nature of the information conveyed. Hence, an analysis of the nature of the four story nodes that varied in memorability in the different media may help to interpret these results. The setting node describes the story locale, including place, time and character information. Beginnings establish the initial events to which the characters react. Goals and reactions constitute internal states of characters. There is an obvious difference in the ease with which setting and beginning story information can be visually presented compared to goal and reaction information. One interpretation of the present findings is that story information that lends itself to pictorial presentation is better recalled in the television condition, while story information that is not easily pictorially presented is better recalled in a nonpictorial medium.

These results can be viewed as an extension of the findings of Meringoff (1980) and Beagles-Roos and Gat (1983) who also investigated how memory for story information varied as a function

of the medium of presentation. However, there was no theoretical or logical rationale given for the choice of story information examined in these previous studies. A major strength of the story grammar approach is that it not only includes a description of the nature and utilization of a story schema but also provides a principled method for describing and analyzing story texts. Hence, the use of a story grammar in the present research to identify and define basic story constituents provides new and more systematic answers to the question, "How does memory for story information vary as a function of the medium?"

Absolute levels of performance were also compared for five additional measures: (a) recall of total number of story propositions; (b) picture recognition; (c) sentence recognition; (d) picture reordering; and (e) sentence reordering. The pattern of results was identical. Memory performance was better in the television condition than in either the text or radio conditions. There was no difference in absolute levels of performance in the text and radio conditions. These findings are somewhat different from the results reported by Pezdek and Lehrer (1983), who found that memory and comprehension were generally similar in the television and text conditions and significantly higher than performance in the radio condition. An important methodological difference in the two studies, which may account for the discrepant performance in the text condition, was in the nature of the reading task. In Pezdek and Lehrer (1983) the text condition included colored pictures,

unlike the present research. Apparently, adding pictures to text makes memory for text similar to memory for television. Memory for a text without pictures, however, appears more similar to memory for a radio story.

In all three media conditions, above average readers generally performed better than average readers. This finding is not surprising and supports the view that positive correlations exist among a broad range of cognitive abilities (Hunt, Lunneborg, & Lewis, 1975). More interestingly, above average readers made more addition and distortion errors than did average readers. Their recall of story propositions included more elaborations, inferences and extra story information than did the recall of average readers. This finding replicates previous research (Brown, Smiley, Day, Townsend, & Lawton, 1977; Paris & Lindauer, 1976), and supports the conclusion that higher order cognitive processes such as those involved in story comprehension and memory differentiate good and poor readers.

The media by reading group interaction was also an interesting finding. Recall performance of above average readers was similar in the three media conditions. Average readers, on the other hand, recalled more in the television than radio condition. One explanation for this result lies in an examination of the various symbol systems utilized in the different media. It has been suggested that poor readers have a general difficulty with decoding, storage and retrieval of printed and spoken words (e.g., Perfetti & Goldman, 1976; Waller, 1976). This position is perhaps best

exemplified by Vellutino (1977) and the verbal-deficit hypothesis. This difficulty of poor readers would be exacerbated in an audio as compared to text presentation because the pace of decoding would not be under the control of the subject nor would the subject be able to visually refer back to previous story information. In the television condition, on the other hand, pictures provide an additional source of information input that is iconographic and consequently easier for poor readers to decode.

The preceding results imply that schools should make a greater use of television for the purpose of presenting stories to students of poorer reading ability. Greenfield (1981) concurs, based on her finding that middle-class black children recalled more of a televised story than working class white children who, in turn, recalled more than middle-class white children. In addition, the results of the present study call into question the appropriateness of presenting stories in radio form to students of poorer reading ability.

The results reported here comprise a first step towards understanding the differences in schematic processes for stories presented in television, text, and radio form. Although story grammars, as they are presently conceived, are adequate for the purpose of a cross media study, suggestions for future research center on the modification of story grammars for use with actual television programs. A reconceptualization of story grammars might include: (a) a mechanism for parsing the visual as well as auditory tracks, and (b) varying the levels of specificity for which the

story grammar would be appropriate. The reconceptualized story grammar might accurately describe all television shows within a program genre (e.g., cops and robbers), a particular program (e.g., CHIPS), or a particular episode within one program. The story structure would be revealed through recall protocols and careful content analysis of the television program(s). As we have all grumbled on occasion, television programs are predictable. Future research should focus on the genesis and nature of our program expectations and their subsequent effects on cognitive processing.

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Table 1

Story Recall as a Function of Media and Reading Conditions

	Above Average Readers			Average Readers		
	TV	Text	Radio	TV	Text	Radio
Total number						
story propositions	33.92	27.25	32.75	22.00	17.92	9.92
Setting	.33	.13	.25	.27	.00	.12
Goal	.38	.42	.42	.12	.42	.08
Beginning	.61	.49	.54	.49	.36	.15
Attempt	.59	.49	.58	.36	.29	.19
Outcome	.57	.43	.51	.31	.27	.14
Reaction	.08	.17	.50	.00	.31	.08
Ending	.58	.51	.65	.44	.28	.21

Table 2

Mean Recognition and Reordering Test Scores for
Above Average and Average Readers

	Above Average Readers			Average Readers		
	TV	Text	Radio	TV	Text	Radio
Picture						
recognition ^a	2.49	2.43	2.16	2.49	1.37	.75
Sentence						
recognition ^a	1.79	1.10	1.51	1.29	.85	.64
Picture						
reordering ^b	.08	3.04	2.85	.36	3.20	4.54
Sentence						
reordering ^b	.42	1.59	1.77	3.38	11.80	14.16

^ad' values

^bdisplacement scores